and then the resemblance, as in a case I saw with Dr. Arthur V. Meigs,[1] is really to typhoid fever rather than to prolonged cases of simple continued fever.

Anæmic fever, such as we sometimes meet with in chlorosis, much oftener in pernicious anæmia, is another form of misleading fever. The look of the patient, the chemical and microscopical blood-tests, explain the irregular pyrexia, which I have seen, however, last several weeks at a time. Temperatures above 103° are extremely rare. The fever that may attend purpura, especially purpura hemorrhagica, is of the same kind; it may be continuous, but it is not high. By way of exception, hysteria is, at times, attended with continuous fever that is likely to show a distinct afternoon rise of temperature. Hysterical fever has been especially studied by French observers. It must be due to a disturbance of the functions of the heat-centres. Osler[2] reports a case that lasted over four years. We can only recognize hysterical fever by the neurotic history and the attending phenomena. There are nervous disorders in which prolonged fever also happens. It may be met with in chorea. In Goodhart's interesting article on "Innominate Fever,"[3] a case of a boy is mentioned who had protracted, irregular fever, and who had had chorea and possibly tetany, and left the hospital, after a six months' stay, with the fever uninfluenced. In all these fevers of nervous origin the temperature is apt to vary very much.

There are further groups of cases of organic change in which fever more or less continuous is observed; in persons, for instance, with rather rapidly advancing arterio-sclerosis, and in lithæmics. Then, too, we see cases in which there is organic disease, as of the endocardium, or of the lung or pleura, or duodenal catarrh, in which the lesion discernible is but slight, but in which, whether from slow absorption of morbid products, or idiosyncrasy of the patient, continuous fever is encountered. In cases of catarrhal pneumonia, or local plastic pleurisies, I have often known this happen. To this group, I think, belongs the case detailed by Chesman Barker,[4] in whose experience fever lasting twenty-two days arose, without apparent cause, after an attack of pleurisy. In further instances, as in Hale White's[5] analysis of Inexplicable Pyrexia, albuminuria was found, and the question is raised whether the lesions are not due to the fever rather than the fever to the lesions. Connolly's[6] forty-four cases of continued fever consequent upon immersion in flood-waters, cannot, I believe, be regarded as idiopathic continued fever, but seem rather to be catarrhal jaundice.

The protracted continued fevers do not happen in epidemics, nor are there relapses. Recurrences may, however, occur in the acute lithæmic fever, if such I may designate it. I have seen a case in the wife of a physician, with nine or ten attacks in six years, no one lasting over a week, but with very high temperatures, and very scanty urine. The point may well be raised, as the attacks are short, not long, whether, strictly speaking, acute lithæmic fever ought here to be considered.

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[1] Transactions of the College of Physicians, 1886, vol. viii.

[2] Practice of Medicine, second edition, p. 1029.

[3] Guy's Hospital Reports, 1888, vol. xxx.

[4] British Medical Journal, July, 29, 1893.

[5] Ibid., December 4, 1886.

[6] Australian Medical Journal, May, 1893.

These continued fevers of long duration are, like the ordinary short simple continued fevers, almost never fatal; the form observed in the tropics has a less favorable prognosis than the other kinds, though there, too, the proportion of deaths is small. No lesions are found except congestion of internal organs. The spleen is not markedly enlarged. Slight meningeal exudation has been occasionally noted. I know of no accurate blood-examinations. It is a mere matter of surmise what, in any of the varieties of the prolonged simple continued fever, causes the fever. That it is due to a disturbance of the heat-centres seems certain. But what gives rise to this disturbance? Is it one cause, or are there several? Leaving out the hysterical cases and those of nervous origin, it appears to me likely that the fever originates from causes within the body; that either as the result of fatigue or overwork, or from impure water, or some preceding digestive disturbance, as happened early in both the very prolonged instances recorded at the beginning of this paper, leucomaïnes form from vitiated secretions, of a character to disturb the heat-centres. Whether in the continued fever of the tropics heat acts also in this way, or more directly, or through blood-changes produced, is a matter on which we can, with our present knowledge, only speculate. Both here and in all these prolonged continued fevers there is a great field for chemical research, especially in the leucomaïnes of the uric-acid group.

The treatment of the prolonged simple continued fevers is purely symptomatic. Quinine has no effect on them; nor have the ordinary antipyretics more than a temporary influence. Phenacetin and salol do most good, particularly in cases with headache. They are best given in small doses, a grain or two, frequently repeated, until their effect is manifest. Better still, where it can be efficiently carried out, is the cold-bath treatment, not only to lower temperature, but for its revulsive and alterative influence. I regret that in the extremely long cases first mentioned circumstances prevented it from being thoroughly carried out. Purgatives, unless contraindicated by weakness, always form part of judicious treatment.

Age. In 32 cases no age was given; 9 cases were under thirty years; 28 between thirty and fifty; and 42 were over fifty years, thus showing a more frequent occurrence as age advances.

Causation. In four cases there had been a previous fracture of the patella, which may have served as a predisposing cause; in 14 cases the cause was not stated; 75 cases had made a misstep, slipped, and fallen; in 20 cases it had been due to some other cause. This proves the generally expressed opinion to be true, namely, that this rupture is most frequently due to an *indirect* cause—the violent contractions of the quadriceps—and not to a *direct* cause, which might be true when the rupture was due to an external blow or to a fall upon the knee. The mechanism of this indirect cause may be easily explained. One makes a false step, his foot slips, he loses his balance, his knee is bent forward, while his body is bending backward. In this position, when the leg is partly flexed, the leverage is very much greater than when the extension is complete. Just at this moment of danger the muscles seem to be so stimulated by an instinct for preservation—to prevent the body from falling—that they spontaneously and suddenly contract very violently; thus there is an intense strain brought to bear upon the quadriceps and its tendons. The patella may be fractured or a rupture may occur, either in the muscle or in its tendon, or at the points of attachment.

Location. The rupture occurred about equally upon the right and left sides; in 15 cases both sides were simultaneously ruptured; in 29 cases the rupture took place at the insertion of the quadriceps tendon on the patella; in 13 cases it occurred in the tendon itself; in 14 cases at the junction of the muscle with the tendon, and in 12 cases the muscle itself was ruptured; in 44 cases the location was not stated. The more careful observers located the seat of the rupture most often at the patellar insertion.

Symptoms. 1. The most frequent and important one is the loss of extension of the leg; there is an inability to walk after the accident. In some cases, however, this ability to stand and to walk remains; in these the rupture was probably either incomplete—that is, all the fibres were not ruptured or the lateral prolongation of fascia were unusually strong and so maintained the leg in extension. By a *complete* rupture is meant one extending entirely through all the fibres of the common tendon. Whether this rupture was more often complete or incomplete does not seem to have been definitely stated in the majority of cases; however, the inference from their histories indicates that the rupture was generally complete. Often the patient hears a loud cracking sound at the moment of rupture.

2. A depression is generally found at the seat of the rupture in which one can place one or more fingers. In partial ruptures this depression

is less. Also after some hours, if there is much effusion, this depression is filled up. This symptom is lost and has an appearance of hydrarthrosis. One must differentiate a severe contusion from a partial rupture. Err on the safe side.

3. The width of this separation between the divided tissues varies; in 17 cases it was less than one inch; in 14 between one inch and one and one-half inches; in 9 cases between two and three inches. In most cases it was less than one and one-half inch.

4. An increased mobility of the patella can be distinguished because its upper attachment is torn away; it can be displaced downward much more freely or moved easily from one side to another.

How often the capsule of the joint is lacerated in this accident can be definitely ascertained only in those cases in which the capsule is opened, as in the sutured cases, and up to the present there have been but few such cases operated upon. Among the 21 cases which were sutured above the patella the capsule was stated to have been opened in 10 cases. Among the 20 cases sutured below the patella 12 were reported to have been opened.

Whenever the rupture occurs at or near (within 5 cm.) the edge of the patella the capsule is generally opened, for above the patella the capsule extends upward behind the rectus tendon 5 cm., while below the patella the anterior wall of the capsule is so closely adherent to the posterior surface of the patellar ligament that if the ligament is completely ruptured and the ends widely separated the capsule must also be ruptured. As it is said that in the larger number of cases the rupture occurred at or near the edge of the patella, so it may be that the capsule is often opened. (Fig. 2.)

Rupture below the patella has been generally described as a rupture of the *ligamentum patellæ.*

Sex. It occurred in 111 males and in 11 females; in 18 cases the sex was not stated.

Age. 34 cases were under thirty years of age, 55 cases were between thirty-five and fifty-five, and 10 cases were over fifty-five years.

Cause. In 17 cases there had been a previous fracture of the patella, which may have served as a predisposing cause; in 19 cases the cause was not stated; 35 cases were due to some other cause, and 86 cases had resulted from a misstep, slip, or fall. Here, again, as above the patella, the largest number were due to an *indirect* cause, the person having slipped and fallen, and its mechanism is the same.

Location. The rupture occurred about equally upon the right and the left sides; in 6 cases both sides were simultaneously ruptured; in 25 cases it occurred at the tendon's point of insertion on the patella; and in 31 cases at its insertion upon the tuberosity of the tibia, thus showing a slightly increased tendency for the rupture at this latter location. In

13 cases there were small bony fragments torn away with the ruptured tendon from either the patella or the tuberosity. In only 3 cases did the rupture occur in the middle of the tendon itself.

Symptoms. 1. In this location the rupture is generally complete, so that the most frequent and pronounced symptom is the loss of extension. There is an inability to walk or to stand after the accident. There have been reported 8 cases in which the rupture was incomplete, and in these there was no loss of extension; in each case it was assumed that some of the fibres of the ligamentum patellæ remained intact.

2. A depression can generally be made out between the separated ends.

3. This separation was less than one inch in 14 cases; in 26 cases it was between one and one-half inch.

4. An increased mobility of the patella can be distinguished. It can be displaced upward easily. In some cases, in which there are fragments of bone which are torn away, crepitation may be distinguished; the capsule is probably more frequently opened here than above the patella, because of its anatomical arrangement.

Treatment. As it has been shown that the mechanism and the loss of function are the same whether the rupture occurs above or below the patella, so it is seen that in both of these classes a similar general plan of treatment is indicated: that is, first to procure a firm union of the structures, and, second, to prevent stiffness or lameness. This may be accomplished either by mechanical or by operative methods.

The mechanical mode seeks to reduce the swelling, to promote absorption, and to prevent any inflammation; to approximate the separated parts by a relaxation of the muscles, and to maintain these parts in apposition, in proper position, by the use of suitably adjusted pads and straps, the leg being preferably supported upon an inclined plane. Finally, to favor early use and to prevent stiffness or lameness by timely massage, electricity, and passive motion.

DETAILS. When the patient is in bed upon his back the leg should be raised by the foot, so that a firm, even bandage can be carefully applied from the toes to the hip. Then one should apply a posterior splint, preferably one of wire which can be easily bent, reaching from a few inches above the ankle to near the gluteal fold. Now the main object to be attempted is to approximate and keep in contact the separated ends of the ligament. This can be best accomplished by carefully adjusted pressure upon the patella to keep it in its normal position, but this pressure must be so gradually applied as not to cause any irritation. One must comprehend exactly what has happened and what now is present. There has probably occurred a rupture into the joint, followed by a pouring out of blood, together with a large effusion from the synovial sac into the joint; thus there exist an acute synovitis and bursitis; therefore no harsh treatment of forcible pressure should be applied, lest the irritation should provoke a destructive suppuration.

When the rupture is below the patella a graduated pad is placed above the patella to prevent it from retracting and to keep it fixed in its normal position. This pad is to be retained in position by a strap of adhesive plaster passing over it, then forward and downward around the lower leg. In case the rupture is above the patella the pad is to be placed below the patella and is secured by a strap passing upward and backward around the thigh. A figure-of-eight bandage is placed over this around the knee.

The leg is then placed upon an inclined plane, as this is a much more favorable position than a horizontal one for relaxing the muscles. The foot should be raised about six to eight inches above the level of the pelvis. An ice-bag should be placed over the seat of rupture. If the rupture is near the joint, the capsule probably has been ruptured, and there has been an effusion. If there is a very large effusion, it is better at once to aspirate rather than to wait for its absorption, which will not only be slow, but also the large clots between the separated ends will prevent an early union, and thus interfere to prolong the recovery.

This aspiration should only be done under absolutely aseptic conditions, otherwise it must not be attempted. After seven to ten days the swelling will have so diminished that the pad and bandages should be readjusted. If the swelling has nearly disappeared, a light plaster-of-Paris bandage may be applied over the others. At the end of four weeks it should be cut away and only a posterior splint applied. Massage and electricity are now to be given to keep up the nutrition of the muscles. The next week the patient should begin to use crutches, and also passive motion, which should be quite gradually increased.

The patient must be careful to avoid any undue strain, which may cause re-rupture during the first three months after the accident, for it has been shown by careful[1] investigations that it requires about ninety days for the effused plastic material to reorganize into a new tendinous structure, which shall be as strong as necessary for the normal functions.

Results of Mechanical Treatment. These may be grouped into three classes: First, those who made a *complete* recovery; that is, who obtained a return to normal flexion and extension, a freedom from stiffness or lameness, and the ability to go up or down stairs without inconvenience. Second, those who acquired a *useful* leg; here the recovery was not complete, in that there was more or less stiffness and sometimes inconvenience upon going up or down stairs; still, the limb was useful enough to allow the patient to pursue his usual duties. Third, where the result was *unsatisfactory* owing to the marked lameness or stiffness and sometimes ankylosis, which persisted. The results in the cases where the *quadriceps* was ruptured will first be considered. Among Maydl's 61 cases 56 were complete ruptures and 5 were incomplete. In these 56 cases the end-result was stated in 40 cases. In 24 cases, 60 per cent., complete recovery followed. Nine cases acquired a useful leg. The 7 remaining cases were unsatisfactory.

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[1] Burse: Deutsche Zeitschrift f. Chirurgie, N. 33, p. 30. Enderlin: Arch. f. klin. Chir., xlvi. Heft. 3, 563.

In regard to the 5 incomplete ruptures the result was not stated in 1 case, but in the other 4 cases the recovery was complete. Less time was required for their recovery than for the complete cases.

Among the writer's 33 cases, 8 were incomplete and 25 were complete; of the latter the end-result was stated in 23 cases. In 16 cases, 70 per cent., complete recovery followed. In 5 cases a useful limb was obtained. The 2 remaining cases were unsatisfactory.

RUPTURES OF LIGAMENTUM PATELLÆ. Among Maydl's 63 cases the end-results were stated in 42 cases. In 27 cases, 64 per cent., complete recovery followed. Six cases acquired a useful limb. Seven were unsatisfactory, and 2 had marked ankylosis.

Among the writer's 57 cases 8 were incomplete and 49 were complete; of the latter, the end-results were stated in 36 cases. In 27 cases, 75 per cent., complete recovery followed. Five acquired a useful limb. Two were unsatisfactory, and 2 had complete ankylosis. There have been found but 8 cases of *incomplete* rupture; in 1 case the result was not stated. In 6 cases complete recovery followed; 4 within six months; 1 case obtained a useful limb.

This increase in the percentage of complete recoveries among the writer's cases may be due to the improved modifications in the treatment, as the study of this subject has advanced, and also to the fact that in Maydl's tables the ultimate results were not stated in 17 cases, 30 per cent., whereas in the writer's tables many more of the cases have been traced, so that in only 3 cases, 9 per cent., have the results not been stated.

The two factors which seem to affect the prognosis the most unfavorably are the age of the patient and the increased distance between the separated ends. The older the patient and the wider the separation the less frequently is the recovery a complete one. This ratio becomes much greater when the age exceeds fifty years and the separation is more than one and one-half inches. A comparison between the above tables would seem to indicate that there is a little larger percentage of complete recoveries in the case of rupture of the ligamentum patellæ than of the quadriceps. This may perhaps be explained by the fact that in the treatment it is much more difficult to approximate and to retain in apposition the separated ends of the quadriceps than of the ligamentum patellæ. One cannot easily hold the quadriceps, for it slips away more freely, whereas one can better hold the ligamentum patellæ by the grasp upon the patella.

	Quadriceps.	Ligamentum Patellæ.
Maydl	60	64
Walker	70	75

It was observed in the few cases of incomplete rupture, where the structures were still held together by a few remaining fibres, that they were more frequently followed by a complete recovery and that the duration of their treatment was shorter. Hence the surgeon desired to accomplish this same end in the case of complete ruptures by an immediate suture. He succeeded in placing these complete ruptures under even more favorable conditions for an early recovery, in that he was able to ligate the oozing vessels, to remove the clots between the separated ends and thus to approximate and suture the divided structures. Lessening the period during which the leg must remain fixed allows earlier passive motion, which is an especially important factor in producing a complete recovery. For it is a well-recognized fact that the earlier passive motion can be begun after any injury about a joint, the less stiffness will there be and so much more favorable a recovery will follow.

In many cases there is at first more or less ankylosis, which is due partly to the passive contraction of the articular ligaments as a result of the long disuse.

Again, in several cases there has resulted an impairment of function on account of an inefficiency of the quadriceps, which was due to its atrophy and which had followed a too prolonged confinement in bed with absolute quiet. In most cases this stiffness and atrophy would not have persisted if passive motion had been earlier employed.

As it is only within the last few years that the operative treatment has been employed, so there are but few cases to be considered. One cuts down to the seat of the rupture, secures, approximates, and unites the separated structures by sutures of silkworm-gut, catgut, kangaroo tendon, or silver wire, the incision is closed with or without drainage, and the limb placed upon an inclined plane for ten to fourteen days. At the end of two to three weeks massage, electricity, and passive motion are begun and gradually increased.

Results of the *operative* method in the case of the quadriceps: There have been 21 cases of this rupture so treated; 19 cases, 90 per cent., made a complete recovery; 12 within three months and 7 within six months. The time was not stated in 1 case. In 1 case the result was doubtful, "four months only slight power of extension;" in this case the joint was opened and the patella fractured. There was no mortality nor any other complications. In 10 the capsule was found to have been opened; in 12 catgut was used for the suture; in 1 silver wire; in 5 silkworm-gut. In 4 cases drainage was used, and in 5 other cases no drainage was employed. These 9 cases each recovered in about equal periods of time.

Results in the cases of the ligamentum patellæ: There have been 20 cases thus treated, and in 16 cases, 80 per cent., complete recovery followed; 8 within three months and 3 within six months. In 5 the time was not stated. There was only 1 case of ankylosis, which occurred in 1839; this patient fell upon a scythe and the joint was opened. The early preaseptic date accounts for the ankylosis. There has been no mortality.

In 12 cases the capsule was opened. For the suture, 4 used catgut, 6 silver wire, 4 silkworm-gut. Drainage was used in 4 cases, and in 4 cases it was not used. All cases recovered in about equal periods.

Thus the writer has tabulated 41 cases treated by operation, with 35 cases, 86 per cent., of complete recoveries; in the 6 other cases the results were not stated, but their histories would indicate that they also recovered.

SUMMARY. 1. The patella is to be considered as a sesamoid bone developed in the tendon of the quadriceps, and the ligamentum patellæ as the proper tendon of insertion of the muscle.

2. The rupture occurs about equally above and below the patella, is generally complete, and causes an entire loss of function. In a small number of cases the rupture is incomplete, and here loss of function may not follow.

3. The rupture is most often due to an indirect cause, as slipping or falling, and occurs more frequently between the ages of forty and fifty.

4. Its seat of location is most often at or near the tendon's insertion on the patella or on the tuberosity of the tibia. The patella becomes more freely movable and a depression is found in recent cases between the separated structures. The amount of separation varies, increasing when the leg is flexed and diminishing when the leg is extended; it is generally less than one and one-half inch.

5. In summarizing the best results of the *mechanical* treatment we find that 70 per cent. of the cases of rupture of the quadriceps made a complete recovery. Of these 18 per cent. recovered in three months; 31 per cent. in six months; and 50 per cent. in one year. In regard to the rupture of the ligamentum patellæ 75 per cent. made a complete recovery, and of these 7 per cent. recovered in three months, 33 per cent. in six months, and 63 per cent. in one year.

6. Under the *operative* method an earlier recovery followed; in the case of the quadriceps 90 per cent., and of these 56 per cent. recovered

within three months and 100 per cent. in six months. In the case of the ligamentum patellæ 80 per cent. recovered; of these 50 per cent. in three months and 100 per cent. in six months.

In comparing the averages we find that under the mechanical mode 72.5 per cent. recovered completely, 12.5 per cent. in three months and 32 per cent. within six months. Whereas under the operative method 86 per cent. recovered completely; 50 per cent. within three months, and 100 per cent. within six months. Thus, under the operative method there has been not only a much larger percentage of complete recoveries, but also the duration of the treatment has been very much shortened without being followed by any increased danger of mortality in the hands of the skilled surgeons.

CONCLUSIONS. 1. In recent cases where there is not much effusion and the joint is apparently not opened, where the separated ends can be approximated and detained by suitably adjusted pads, the mechanical treatment may be carefully considered. In the hands of the intelligent general practitioner this method may be expected to bring about a complete recovery in the larger number of cases. From nine to twelve months will be required to re-establish fully the normal functions.

2. A too prolonged fixation in bed is unfavorable to an early recovery, therefore early massage and passive motion are strongly advised.

3. The skilled aseptic surgeon who primarily resorts to the operative method in suitable cases (but the age and vitality of each patient must be most carefully considered) may quite reasonably hope to obtain a better result in a larger number of cases and save his patient three to six months' time.

Catgut, kangaroo tendon, or silkworm-gut should be used, and when there is much effusion drainage should also be employed.

4. When the separation is greater than one and one-half inch or when the case has not recovered under the mechanical treatment, the operative is indicated.

5. As the length of time required for treatment is a very important consideration, so the operative method, which has diminished this period and also succeeded in a larger number of cases without increasing the danger, will be more often indicated and more frequently applied in the hands of the skilled surgeon.

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